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CHANGE CONTROL OF SOFTWARE AT LANL

by

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ABSTRACT

Change Control is the process by which the Computing and Communications Division (C Division) at Los Alamos National Laboratory (LANL) updates software and hardware used by its customers. This paper concentrates on the control of changes to user-level software, such as languages, libraries, and utilities. It describes how these changes are documented and how automated tools have been and are being incorporated into the change control procedures to improve efficiency.

INTRODUCTION

This paper discusses the Change Control process, the role of documentation in Change Control, and finally, some of the tools that are used and that are being implemented.

CHANGE CONTROL PROCEDURE

History

Before September 1980, software changes were introduced into the computing environment as needed and announcements were made after the fact, in a monthly publication called the *Computing and Communications Division News*. Changes in the ICN (Integrated Computing Network) occurred almost daily, a very frustrating situation for a research and development laboratory. At the same time the computing environment was becoming more complex as new machines were added to the network.

Current Procedure

Obviously, it was time to develop a systematic scheme to ensure maximum stability of software on all systems, and to control the scope and timing of these changes. During September 1980 the following procedure was implemented, and is still in place today with only minor changes.

1. All modifications for a specific month are announced at the same time in the monthly *ICN Change Bulletin*, which is a C-Division publication that is distributed by mail to all ICN users during the week of the first Tuesday of each month.

2. By the first Tuesday, new and modified software is made available as experimental files for testing by users, who feel they might be affected by the announced changes. This initial testing period gives the user an opportunity to uncover problems in the software before changes become permanent.

3. On the second Tuesday of the month, modifications become the standard public software on the operating systems of one of the machines with the same architecture in each security partition.

4. On the third Tuesday of the month, if no problems are reported to the consultants in C-Division's Consulting Office, modifications are installed on the remaining machines.

Tuesday was chosen as the day that would cause the least disturbance to the heavy weekend production schedule.

Interim Changes

If problems surface between the first and third Tuesday, the software can be reinstalled with new corrections or backed off to the previous month's version of the software. There have been very few cases of the latter situation. The impulse is usually to move on towards perfecting the latest software versions. For critical software such as libraries, compilers, and loaders, there frequently IS NO stable past software. New hardware and operating systems require a certain shakedown time before stability and reliability are attained.

Please note that the most stable environment possible exists between the third Tuesday of the month and the second Tuesday of the following month, nearly three weeks.

Documentation

A BULLETIN utility is used by the programmer to enter the necessary information for the upcoming *ICN Change Bulletin* news article. The deadline for doing this is around the twentieth of the month. Three days later, the first review of the *ICN Change Bulletin* is mailed to the authors, editors, and consultants for corrections and changes. Several days later, the second and final review is submitted to the same people for final confirmation before it goes to the printer on the Wednesday before the first Tuesday of the month. Distribution of the monthly *ICN Change Bulletin* occurs during the week of the first Tuesday, just in time for the user to test the experimental version before it becomes a public file.

Online News

An online ICNNEWS utility is available for users to print the index of the current monthly *ICN Change Bulletin* on their terminal screen. Updates occur on the first of the month, which means that this information is available before the *ICN Change Bulletin* is distributed. ICNNEWS also provides a convenient way for the Change Control Coordinator to announce interim bug fixes or system changes that would be of general interest to the user community. These notices are added during the month as the need arises.

CFS Group Nodes

Programmers are requested to put up executable binaries on their CFS group nodes at the time they submit their *ICN Change Bulletin* article. (CFS is the Common File System, LANL's massive file storage system available to all machines on the ICN.) These files are not picked up by the system manager until the first Tuesday of the month. During the intervening ten days, the programmer is encouraged to test the product as thoroughly as possible.

Reasons for Software Changes

The vast majority of software changes and enhancements result from user requests. This is not surprising because there are more than 8000 people in the user community.

The second most common reason for software change is related to the mobility of machines. New ones arrive, old one leave. Additional shuffling of machines may have to take place to evenly distribute the worker machines in the different security partitions.

A third reason for software changes is the arrival of bigger and better computers that need more system tables and accounting information. Any system change to the tables necessitates changes in a large number of utilities.

A fourth reason for software modification is changing guidelines and policies. As the computing environment changes, there may be a shift in emphasis from one language to another.

Programmer's Role

User complaints and suggestions are relayed to the Change Control Coordinator most often through the consultants. The Coordinator checks the C-Division Software Manual for ownership of the code. If the owner is not in the C-Division group, C-10, the Change Control point-of-contact for that group is notified and he/she interacts with the owner of the code. Otherwise the C-10 programmer is notified by the Coordinator (also the point-of-contact for C-10) of the request, and a time frame is informally set up for resolution of the problem.

When the modified software has been prepared and tested, the executable is stored on the appropriate group's Change Control CFS nodes. Each group has its own scheme. On or before the twentieth of the month, the programmer submits from his terminal the necessary information that will appear in the following month's *ICN Change Bulletin*. At this time, if the documentation needs to be changed, the alterations should be relayed to the Documentation Group. At this point, the software and documentation have triggered the cycle and the programmers responsibilities have ended.

Coordinator's Role

The Coordinator's most important job is to integrate the various aspects of Change Control into a smooth flowing operation. The following tasks are some of the more visible components of the job:

- Receive complaints and details of software problems.
- Check on ownership of software in the C-Division Software Manual and notify the programmer.
- Edit the two *ICN Change Bulletin* reviews.
- Submit software CFS lists to all system managers by the first of the month.

- Resolve all problems connected with interim bug fixes.
- Write necessary interim ICNNEWS articles.
- "Always" be available to answer questions.
- Willingly assist participants in details of the Change Control procedure.
- Define and/or negotiate responsibilities for programmers, group contact people, system managers, BULLETIN utility, and documentation.
- Be aware there "may be a better way of doing business."

DOCUMENTING SOFTWARE AND HARDWARE CHANGES

When documenting software and hardware changes for users, the users affected by the changes need good documentation and the programmers making the changes need good tools for documenting changes.

The C-Division's Documentation Group is responsible for meeting these needs. Two mechanisms are available for giving users good documentation. Information about monthly changes is published in a document called the *ICN Change Bulletin*. Information about changes that occur between cycles is published in a one page information sheet called an Interim Bulletin, or the information is put online. The BULLETIN utility is a tool programmers use for documenting changes.

The *ICN Change Bulletin*

The Documentation Group receives the following information for the *ICN Change Bulletin* from the programmers making the changes (see Figure 1).

Function
describes what the software or hardware does.

Change
describes the difference between the old and new software or hardware. This section describes the capabilities that are being added or deleted.

X File Access
tells where an experimental file (Xfile) will exist on CFS for user testing.

Schedule
lists the day and machines on which software or hardware is installed.

Documentation
states if documentation needs to be updated and where the documentation can be found.

Stop Sign (not shown in Figure 1)
indicates if the changes are incompatible with the previous version, that is, if the change will cause the users to alter the way they are using the software. A stop sign is placed by the name of the software or hardware.

When the Documentation Group receives an article, the editor sends the programmer a message verifying that the article was received. The editor begins preparing articles for printing by editing and rewriting articles to take out ambiguities and to make the information clearer. Writers are notified if documentation changes are necessary, so they can begin to update the reference documentation about the software. Two reviews ensure the technical accuracy of the information. The *ICN Change Bulletin* is sent to a printshop outside the Laboratory, and it is returned for distribution on the first Tuesday of each month (see Figure 2).

The *ICN Change Bulletin* also contains the following general information:

- Cumulative Index
  documents changes to a piece of software for the past two years. Each entry includes the name of the utility, the operating systems the utility is on, a brief description of the change, and which issue of the *Bulletin* the information is in (see Figure 3). An index for previous years is available on CFS.
- Downtime Schedule
  lists the dates when the C-Division supported computers will be down for the next month (see Figure 4).
- Online Information
  explains how to access online documentation.
- Network Diagram
  shows the current status of the ICN. This diagram shows how machines are connected, what machines are available, and which security partition each machine is in.

The *ICN Change Bulletin* is put online in two forms. A formatted copy is on CFS in a standard text file. Users can retrieve the file, convert it to native text, and use their favorite editor to view it. Past copies are kept on CFS in standard text format for 1-1/2 years. The *ICN Change Bulletin* is also put into a database that is accessible through the ICNHELP utility, which is based on a VMS help library. This utility can be accessed from all computers in the ICN. To read this online information a user types

ICNHELP ICNNEWS

The information on the ICNHELP database is organized in a

hierarchy of topic and subtopics (see Figure 5).

Announcing Interim Changes

Changes, such as backing off software, are sometimes necessary before the next Change Control cycle. To get this information to the users, either a one page information sheet is printed or the information is put online. Before last December, interim information was printed in hardcopy and distributed to users only at Los Alamos. This process took between two days to one week. Because many users of the ICN are not at Los Alamos and information needs to reach them quickly, interim information is now put on the ICNHELP utility under the ICNNEWS topic (see Figure 5). The Documentation Group can now get interim information to the users within two hours.

CHANGE CONTROL TOOLS

Change Control is supported by software tools. The ones already mentioned are the BULLETIN utility to generate articles for the *ICN Change Bulletin* and ICNNEWS used to disseminate interim news about C-Division supported products. Two other tools in use are a procedure to install files on CTSS (this automatically resizes public file space if needed) and SAVEPUB/REPUB, which polls every few minutes for newly installed public files, backs up the newly installed public files on CFS, and is used to reinstall public files on deadstarts. The tools under development are a set of tools to archive C-Division supported software on CFS, and CCMAKE, used to distribute and install UNIX software. This section will briefly discuss the BULLETIN utility along with the tools under development.

BULLETIN Utility

Programmers use the BULLETIN utility to send change information to the Documentation Group. This utility is multifunctional allowing programmers to enter data, edit data, and preview articles. The utility prompts the programmer for information and automatically fills in the function, schedule, Xfile access, and documentation sections using databases. (See Figure 1 for an example of these sections in an article.) It has recently been modified to support the tools archiving C-Division supported software on CFS; it will also generate the mapping between the CFS pathname where programmers keep their software and the CFS pathname where the software will be copied as Xfiles. (Note that these maps are published in the review copy of the *ICN Change Bulletin* articles, but not in the final version.) BULLETIN asks approval before entering information, in case the database information needs to be changed. When programmers finish entering the changes, they can send the article to the Documentation Group by electronic mail by using an option in the BULLETIN utility. Using this tool helps both the programmers and Documentation Group give users consistent and complete information.

Tools to Archive C-Division Supported Software

Four tools are used to archive C Division supported software on CFS.

At the time the *ICN Change Bulletin* is finalized, a parser will collate the mappings between the CFS pathname where programmers keep their software and the CFS pathname where the software will be copied as Xfiles into one file. The parser will also collate the schedules of when software is to be installed on what machines into another file. Then it will store these files on CFS. This will eliminate the need for the sometimes late and/or inaccurate hand-carried lists of where the programmers have stored their software on CFS.

On the day before the first Tuesday of the month, GETXFILE gets the file of maps from CFS, lets the person running it double check that the maps are correct, then uses the maps to copy the software from the programmer's CFS path to change control's CFS path for Xfiles. If the CFS path for an Xfile does not exist, GETXFILE will create it. Note that only a very few people have write access into the change control CFS nodes to prevent unauthorized software from getting into the system.

On the day after the third Tuesday of the month, CCMIGRATE figures out what Xfiles need to be migrated by using the file of schedules, then changes the old floor version to a past version, moves the Xfile version in as the new floor version, and associates a date with the new floor version.

Both GETXFILE and CCMIGRATE keep a complete audit trail, provide for recovery if a run is cut short, and allow for the installation of bug fixes with or without input files.

The last tool is called CCGET. It acts as a database manager and provides many ways to list full CFS pathnames of files or actually get them. For example, to get all the Xfiles for this month for the partition, hardware, operating system, and software type on which you are logged, you would type

```
ccget -a
```

CCMAKE for UNIX Software

CCMAKE is designed to run on any UNIX machine, and therefore will aid efforts not only in UNICOS but in workstations and distributed processing. There are two sets of tools in the CCMAKE package: a set for the programmer and a set for the system manager. The programmer's tools help the programmer follow standards, help ensure all needed information and files are packaged together for the system manager, significantly reduce what the programmer would otherwise have to type in, and minimize the programmer's having to know about system management. The system manager's tools are designed to be flexible and complete

enough to provide all the needed functions to install the majority of software on any UNIX machine and to be reliable with the minimum amount of manual input.

CONCLUSION

The current Change Control procedure has greatly enhanced C-Division's ability to provide the flexibility and stability needed for an effective computing network. Sufficient documentation and software tools are required to guarantee the procedure works properly. In addition, LANL is currently developing and testing new tools with the intent to increase reliability, security, and efficiency of the procedure as well as to support workstations and distributing computing.

SPRINT (CTSS)	
Function.	Converts a native text file to a standard print file.
Change.	The version of SPRINT that is on the CRAY Y-MPs has been corrected. It will not append a suffix to the default output filename PRINTx, where x is the current suffix.
X File Access.	On CFS as /CTSSX/XYMP/SPRINT.
Schedule.	March 14 on 7; March 21 on 6.
Documentation.	Current documentation contains all necessary information. Available in hardcopy as SPRINT Reference (CTSS), September 1987.
	On CFS as /C2DOC/CTSS/SSPRINT.

Figure 1. Example article from *ICN Change Bulletin*.

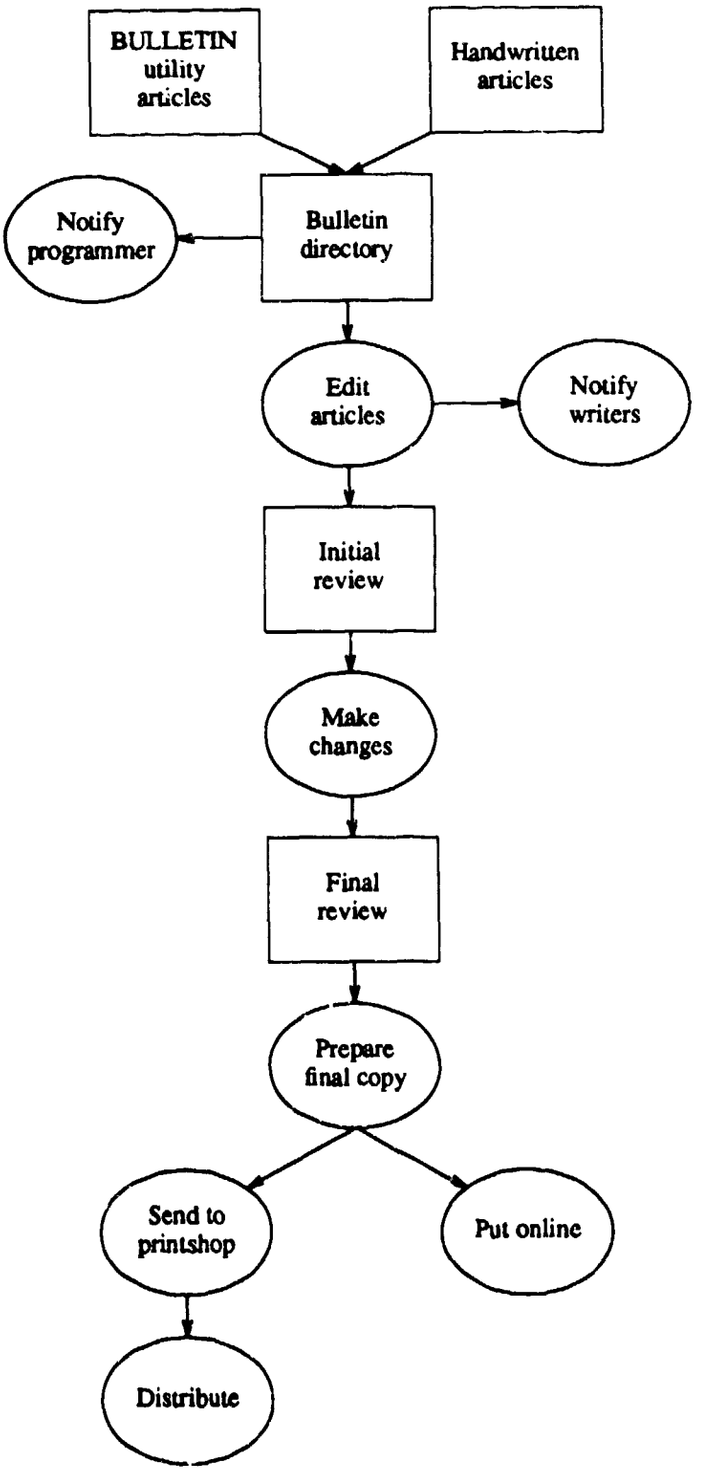

Figure 2. Ensuring accuracy through the documentation cycle.

INDEX

Figure 3. Index from *ICN Change Bulletin.*

Central Computing Facility Scheduled Down Time**

May 1989

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 30	May 1 0600-0700* 1800-2300 (4)	May 2 0600-0700* 1800-2300 (1)	May 3 0600-0700* 1800-2300 (Y)	May 4 0600-0700* 1800-2400 (6)	May 5	May 6
May 7 0800-1300 (J)	May 8 0600-0700*	May 9 0600-0700* 1800-2400 (7)	May 10 0600-0700* 1900-2400 (5)	May 11 0600-0700* 1900-2400 (2)	May 12	May 13
May 14	May 15 0600-0700* 1800-2300 (4)	May 16 0600-0700* 1800-2300 (1)	May 17 0600-0700* 1800-2300 (Y)	May 18 0600-0700* 1800-2400 (6)	May 19	May 20
May 21	May 22 0600-0700*	May 23 0600-0700* 1800-2400 (7)	May 24 0600-0700* 1900-2400 (5)	May 25 0600-0700* 1700-2400 (2)	May 26	May 27
May 28	May 29 0600-0700*	May 30 0600-0700* 1800-2300 (4)	May 31 0600-0700* 1800-2300 (1)	June 1 0600-0700* 1800-2300 (Y)	June 2 1800-2400 (6)	June 3

*Network Dedicated by Mtn Time (DST) can occur from 0600-0700, Monday through Thursday. C-1 will broadcast a message before this down time. If you have any questions, call the shift supervisor at (505) 667-4584

**All times are Mountain Time.

Figure 4. Down Time Table.

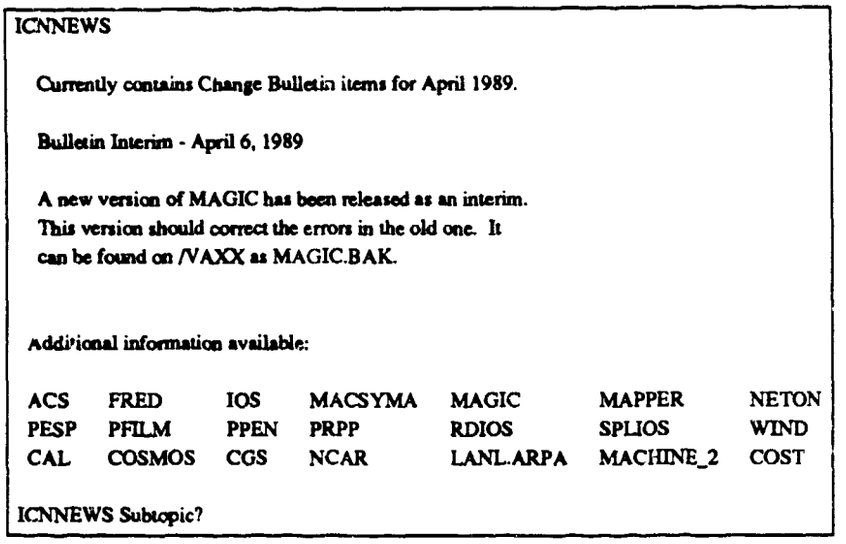

Figure 5. ICNHELP ICNNEWS screen.